# First Electro-Mechanical Actuator Flight Tested on Fighter Aircraft

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## Payoff

The experience gained by flying power-by-wire (PBW) actuators on an aircraft primary control surface provides confidence for the next stop in PBW development - flight demonstration of a more electric aircraft. PBW technology payoffs include elimination of the central hydraulic system, reduced logistics support, increased survivability, improved reliability (increased mean-time-between-failure), and a more efficient use of secondary power.

## Accomplishment

Under a joint Air Vehicles Directorate (VA) and NASA Dryden Flight Research Center program, the first flight testing of a power-by-wire Electro-Mechanical Actuator (EMA) on a fighter aircraft was accomplished in 1998. The EMA is a line replaceable unit that requires electrical connections to the flight control computer and a 270 volt direct current power source. Its control electronics and the high current switching devices occupy a 0.3 cubic foot volume.

## Background

The EMA flight test was the third and final testing of three advanced actuator designs that were flown under the Electronically Powered Actuation Design (EPAD) validation program, managed by VA. The first actuator, called the Smart Acutator, successfully completed flight testing in 1993. Although still dependent on the central hydraulic system, the Smart Actuator eliminated the need for the large wire bundle connecting the flight control computer to the actuator by locating control loop closure and health-monitoring intelligence right on the actuator. The second and third actuator designs are known as power-by-wire actuators because they require no external hydraulic connections. The Electro-Hydrostatic Actuator (EHA), the second actuator design, consists of a small electric motor, pump and actuator ram incorporating about a pint of hydraulic fluid. The EMA, the third actuator, consists of a small electric motor, gear train transmission and actuator ram (ball screw). Both EHAs and EMAs require high current switching devices to control the motors. This control unit replaced the standard hydraulic actuator to the left aileron of NASA's F-18 systems research aircraft.